# ELECTRON EXCITATION CROSS SECTIONS FOR THE $2s^22p^2\ {}^3P_{0,1,2} \rightarrow 2s^22p^2\ {}^1D_2$ TRANSITION IN $O^{2+}$

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Transitions in the $O^{2+}$ ion are detected in a variety of astrophysical objects such as diffuse nebulae-HII regions, planetary nebulae, and the Jupiter-Io torus. The strength of the λλ 4960.9, 5009.0Å lines depends on the brightness of the illuminating central stars, as well as on electron temperature ($T_e$) and number density ($N_e$). In order to convert line intensities to actual $T_e$ and $N_e$ one needs reliable theoretical [1,2] or experimental data. For almost all ionic species, for practically all charge states and transitions, only theoretical data are available, with no comparison to absolute, or even normalized, experimental cross sections. Presented herein are the first experimental measurements of absolute collisional excitation cross sections for the $2s^22p^2\ {}^3P \rightarrow 2s^22p^2\ {}^1D$ transitions (λλ 4960.9, 5009.0 Å) in $O^{2+}$. Comparison is given here with the recent results in a 26-state *R*-matrix calculation of Aggarwal and Keenan [2] for this transition.

The experimental measurements were carried out using the 14.0 GHz electron cyclotron resonance ion source at the JPL HCI Facility [3-5]. The $O^{2+}$ was generated from CO feed gas, and extracted at 2×6.4 keV from the ECR. The metastable fraction was determined from the gas attenuation technique. The fraction was determined for the different daily ECR running conditions, and applied to the measured cross sections.

Present absolute excitation cross sections are shown in Fig. 1. Comparison is given with results in the 26-state *R*-Matrix calculation [2]. Here, the theoretical data were convoluted with an electron-energy resolution of 100 meV (FWHM), the effect of which is to smooth over many of the very sharp, narrow resonances in the theory. Resolution in the center-of-mass frame is dependent on electron energy $E_e$. As in Ref. 6, the convolution of theory shown in Fig. 1 took into account this variation of width with $E_e$. There is seen to be good agreement between present absolute measurements and the *R*-Matrix theoretical results. Especially, one detects experimentally a drop in cross section starting at about 2.6 eV, and going through a minimum at 3.7 eV. Enhanced scattering is clearly detected at the calculated resonance near 4.25 eV.

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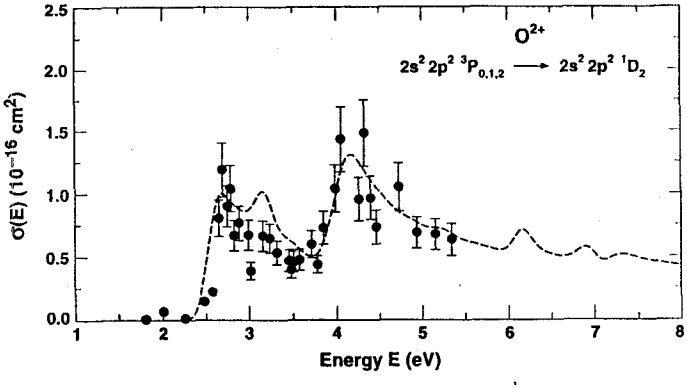


**Figure 1.** Comparison of present absolute experimental cross sections for the combined λλ 4960.9, 5009.0Å lines (solid circles), with results in the 26-state *R*-Matrix calculation (dashed line) [2].

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